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LITIGATION TECHNICAL SUPPORT AND SERVICES

ROCKY MOUNTAIN ARSENAL

PHASE I FINAL Comme
CONTAMINATION ASSESSMENT REPORT
SECTION 22 - NONSOURCE AREA
(Version 3.1)

December 1987
Contract Number DAAK11-84-D0016
Task Number 14 (Army Sites North)

ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.

HARDING LAWSON ASSOCIATES MIDWEST RESEARCH INSTITUTE

PREPARED FOR

PROGRAM MANAGER'S OFFICE FOR

ROCKY MOUNTAIN ARSENAL CLEANUP

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13. ABSTRACT *(Maximum 200 words)*

THIS FINAL REPORT DOCUMENTS THE PHASE I CONTAMINATION SURVEY OF SECTION 22 UNCONTAMINATED WHICH HAS BEEN USED FOR AGRICULTURE AND AS A BUFFER ZONE.

12 COMPOSITE SAMPLES FROM 12 BORINGS WERE ANALYZED FOR SEMIVOLATILE ORGANICS AND METALS WITH SEPARATE ANALYSES FOR HG AND AS. ONLY ONE SAMPLE HAD A TARGET COMPOUND, CD, WITH A CONCENTRATION ABOVE THE INDICATOR RANGE. HOWEVER, THIS CD CONCENTRATION IS NOT CONSIDERED INDICATIVE OF DISPOSAL ACTIVITY.

ON THE BASIS OF PHASE I RESULTS, HISTORICAL DOCUMENTATION, AND AERIAL PHOTOGRAPHS, NO PHASE II PROGRAM IS RECOMMENDED.

APPENDICES: CHEMICAL NAMES, PHASE I CHEMICAL DATA, COMMENTS AND RESPONSES.

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PREPARED BY

ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.

Harding Lawson Associates Midwest Research Institute
Prepared under Task 21

PREPARED FOR

U.S. ARMY PROGRAM MANAGER'S OFFICE FOR ROCKY MOUNTAIN ARSENAL

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Section 22-UNC, forms parts of the northwestern boundary of Rocky Mountain Arsenal (RMA). Section 22-UNC is triangular in shape, encompasses approximately 11,712,227 square feet, and is bordered on the northwest by Highway 2 and the Burlington Northern Railroad. This section is considered to be a nonsource area and was investigated in the fall of 1985 by a Phase I program conducted under Task 14. The Phase I program consisted of 12 borings drilled to depths of 5 feet (ft), with one sample composited from the 0- to 1-ft and 4- to 5-ft intervals. A geophysical survey was not performed, since historical evidence indicated that Section 22-UNC was not used for the disposal of contaminated material.

Phase I results show only one sample had a target substance, cadmium, with a concentration slightly above the indicator range. The other 11 samples did not contain detectable levels of cadmium. The cadmium concentration is not considered to be indicative of disposal activity, because historical evidence, aerial photographs, and visual observations did not indicate burial or disposal in Section 22-UNC. Nontarget compounds identified in this section were primarily unknown hydrocarbons at low concentrations.

On the basis of Phase I results, historical documentation, and aerial photographs, a Phase II Program is not recommended for this section. Because the Phase II investigation indicated that Section 22-UNC is a nonsource area, there is no volume estimate of potentially contaminated soil.

SECTION 22 - NONSOURCE AREA

1.0 PHYSICAL SETTING

1.1 LOCATION

Section 22-UNC forms part of the northwestern boundary of Rocky Mountain Arsenal (RMA). Section 22-UNC is traingular in shape and bordered on the northwest by Highway 2 and the Burlington Northern Railroad. The Northwest Boundary Containment System (NWBCS) is also in Section 22-UNC. Section 22-UNC has an estimated areal extent of 11,712 227 square feet (ft^2) (Figure 22-UNC-1) and is considered to be a nonsource area.

1.2 GEOLOGY

Section 22-UNC is situated in Pleistocene alluvium which consists of interbedded silty sand, gravel, and clay partly covered by a thin layer of eolian sand and silt. The alluvial thickness varies from approximately 20 ft in the northeast quarter of the section to 60 ft in the southern half of the section (Clark, 1985, RIC#85183R01). The alluvium is underlain by the Denver Formation which is characterized by bentonite-rich clay/shale with compact lenticular sand horizons. Lithologic variations present in the Denver Formation include interbedded siltstone, claystone, sandstone, low-grade coal, lignite, and volcaniclastic material (May, 1982, RIC#82295R01; RMACCPMT, 1983, RIC#83326R01; Anderson et al., 1979, RIC#85214R03; Clark, 1985, RIC#85183R01). Phase I borings typically penetrated silty sand or sandy silt, and the Denver Formation was not encountered in any boring.

1.3 HYDROLOGY

The topography at Section 22-UNC varies from 5,175 feet above mean sea level (ft msl) in the southeastern corner of the section to 5,125 ft msl in the southwest. A slight ridge in the center of the section causes surface water to drain westward in the southern portion of the section and northward in the northern portion (Figure 22-UNC-2).

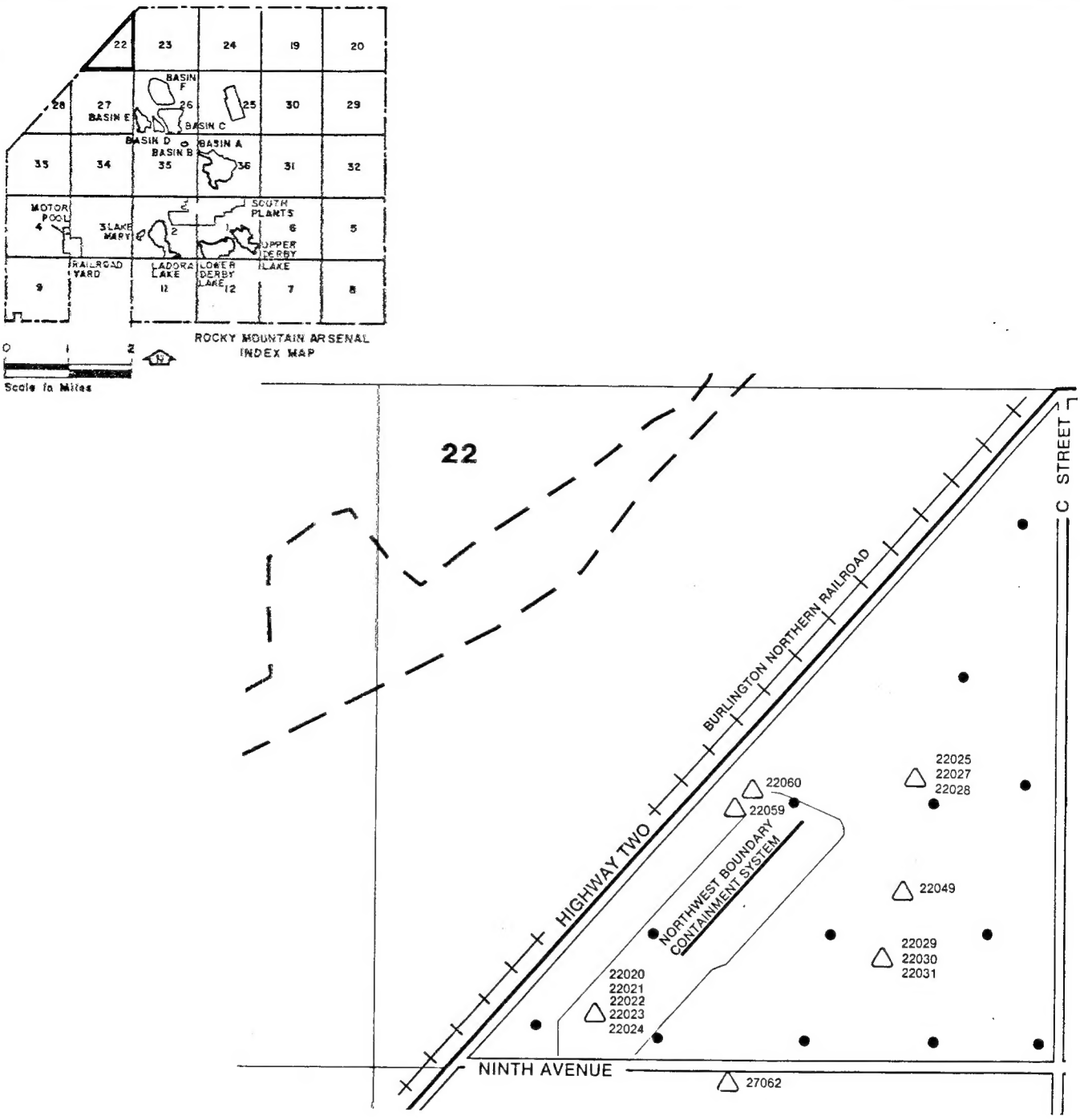


Figure 22-UNC-1
SECTION LOCATION MAP
SECTION 22-UNC
ROCKY MOUNTAIN ARSENAL
SOURCE: ESE, 1987

Prepared for:
U.S. Army Program Manager's Office
For Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

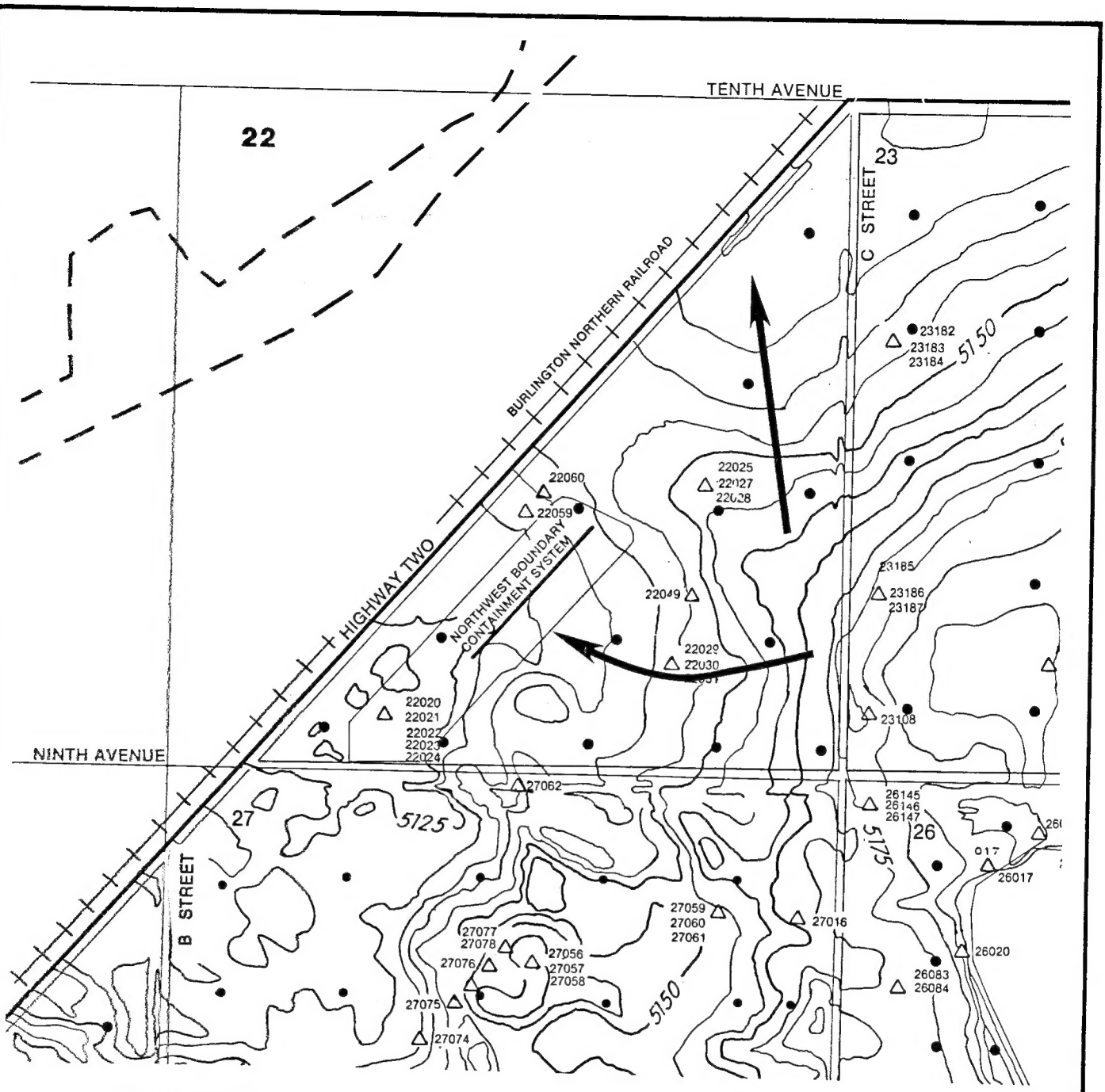
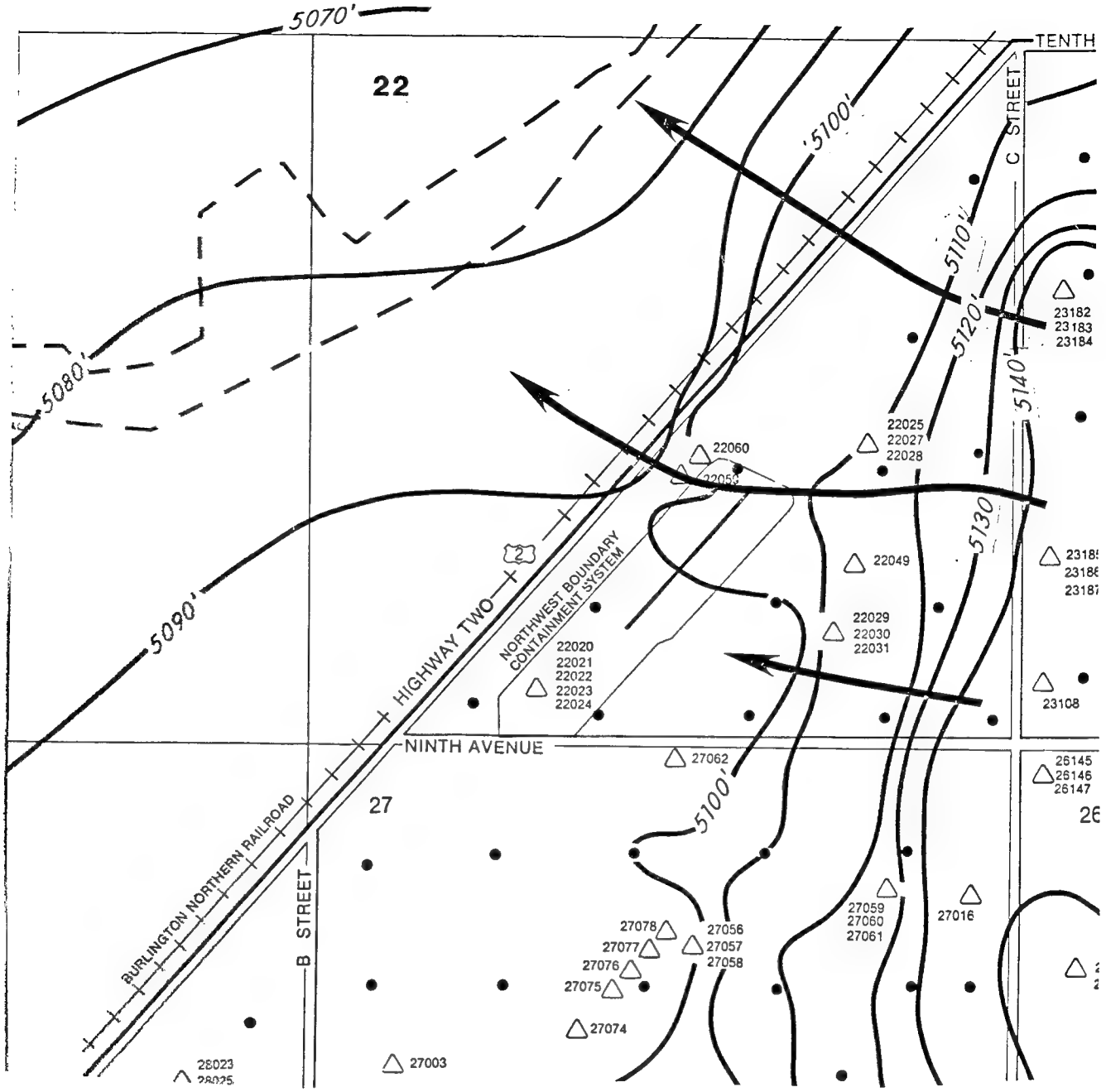


Figure 22-UNC-2
REGIONAL TOPOGRAPHY
SECTION 22-UNC
ROCKY MOUNTAIN ARSENAL
SOURCE: ESE, 1987

Prepared for:
U.S. Army Program Manager's Office
For Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

The ground water contour map of Section 22-UNC (Figure 22-UNC-3) was generated from data collected in March 1986 (ESE, 1986c, RIC#86238R08). The map indicates that the water table occurs at an approximate depth of 30 ft (5,142 ft msl) at the southeastern corner and 35 ft (5,100 ft msl) at the northwestern boundary. Ground water flow is westward across Section 22-UNC, but changes to northwest near the RMA northwestern boundary. No Phase I boring penetrated the water table.

Ground water contamination was detected beneath Section 22-UNC during the Task 4 Initial Screening Program (ESE, 1986c, RIC#86238R08). Chloroform was detected in Wells 22020, 22021, 22022, 22059, and 27062, and dieldrin was detected in Wells 22059, 22060, and 27062. Diisopropylmethyl phosphonate (DIMP), dibromochloropropane (DBCP), and trichloroethane were detected in Well 27062. Benzene was detected in Well 22021. Wells 22025, 22029, and 22049 were dry during the initial sampling period. Data presented here are provided for background purposes and are not intended to be correlated with soil sample analytical results generated as part of the Phase I study. There is no indication that Section 22-UNC contributes to ground water contamination beneath this section. The migration of contaminants in the ground water beneath this section, however, is currently being assessed under Task 25.



EXPLANATION

- Phase I Boring
- Monitoring Well
- Water Table Elevation Contour
- Ground Water Flow
- Ditch

N

1200 0 1200

APPROXIMATE SCALE (in feet)

Contour Interval: 10 Feet

Figure 22-UNC-3
REGIONAL GROUND WATER FLOW
SECTION 22-UNC
ROCKY MOUNTAIN ARSENAL

SOURCE: ESE, 1987

Prepared for:
U.S. Army Program Manager's Office
For Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

2.0 HISTORY

Section 22-UNC was utilized by the Army as a buffer zone for RMA operations as well as being an agricultural area. Section 22-UNC was leased for farming and grazing activities from approximately 1943 until 1969 (U.S. Army Chemical Corps, 1945; Chemical Warfare Service, 1946; Chemical Warfare Service, 1948; RMA, 1963). In 1984, the NWBCS was constructed within the southwestern portion of Section 22-UNC. This 2,600-ft-long system was specifically installed to monitor and treat migrating ground water contaminants (RMACCPMT, 1984, RIC#84034R01). Information for Section 22-UNC from available aerial photographs (RMA, 1980, RIC#83080P02; deMontioney, 1984, RIC#85121P08) may be summarized as follows:

Photograph Date	Description
July 9, 1943	Most of Section 22-UNC is covered with vegetation except for two plowed fields in the northern portion of the section. On the northwest boundary, a 350-ft by 230-ft rectangular area, probably a pre-RMA farm, is surrounded by trees. A ditch extends from the southeast corner of this area east approximately 500 ft, then southeast, and ends before it intersects C Street. An east-west road connects the area with C Street and the northwest boundary.
August 20, 1945	Outlines of fields are still visible and vegetation covers the entire section.
1953	Field outlines which were clearly present in 1945 have gradually faded.
October 15, 1975	The field outlines have almost totally faded throughout the section.
June 25, 1975	Light-colored areas are visible in the northern portion of the section. These areas occur within the prairie dog colonies and are associated with natural variations in vegetation. A similar large, roughly circular area is visible in the southwest corner of the section. A north-south road leads from Ninth Avenue to the tree-lined rectangular area.

September 20, 1980	Four light-colored areas, similar to those noted in the June 1975 photograph, are visible within the prairie dog colony. Two linear features approximately 140 ft long are evident within the 600 ft easement of Colorado Highway 2. Vehicle tracks are visible along "C" Street 1,000 ft north of Ninth Avenue. In the southwestern corner of Section 22-UNC, several dirt roads lead to a building approximately 100 ft long by 60 ft wide. Northwest of this building is a 300-ft-long white linear feature, possibly a pipeline, that trends north.
July 16, 1984	The NWBCS is under construction, and several ground scars are visible along Ninth Avenue and the northwest boundary.

According to historical documentation and aerial photographs, Section 22-UNC was designated as a buffer zone and agricultural area and is considered to be a nonsource area. Also, in recent years in an effort to monitor the migration of ground water contaminants, portions of the section have been utilized for the construction of the NWBCS.

3.0 SITE INVESTIGATION

3.1 PREVIOUS SOIL INVESTIGATIONS

According to the U.S. Soil Conservation Service (Sampson and Baber, 1974), the surficial soil in Section 22-UNC consists predominantly of Ascalon sandy loam (1- to 3- percent slopes), Ascalon-Vona sandy loam (1- to 5- percent slopes), and Platner loam (0- to 3- percent slopes). The Ascalon series is characterized by soil formed in varying amounts of sand and gravel. The Platner series typically forms in old alluvial material. Minor amounts of Truckton sandy loam (3- to 5- percent slopes) occur in the southern part of Section 22. This soil contains wind-worked and wind-deposited sandy material. All of the above soil types are well-drained (Sampson and Baber, 1974). No previous soil contamination studies are documented for this section.

3.2 PHASE I SURVEY

3.2.1 Phase 1 Program

Borehole spacing for this nonsource area was selected at 1,000 ft (Figure 22-UNC-4) based on historical information. All borings were drilled to a 5-ft depth using the continuous soil sampling method detailed in the Task 14 Technical Plan (ESE, 1986b, RIC#86238R04). Samples were composited in the laboratory from the 0- to 1- and 4- to 5- ft intervals unless field conditions [i.e., water table, staining, etc.] required an adjustment in procedure. All samples were taken at predetermined intervals in Section 22-UNC.

Prior to drilling, all boring sites were cleared for safety purposes in accordance with the geophysical program detailed in the Task 14 Technical Plan (ESE, 1986b, RIC#86238R04). A metal detector was used at all boring locations to survey the area for significant amounts of metal debris. If the metal detector indicated debris, the borehole clearance program was expanded to include a gradiometer survey. Significant metal debris was not detected at this section, and no boring locations were moved as a result of the geophysical program. Boring locations, pertinent surficial objects, and historical features from aerial photographs are presented on the boring location map (Figure 22-UNC-4).

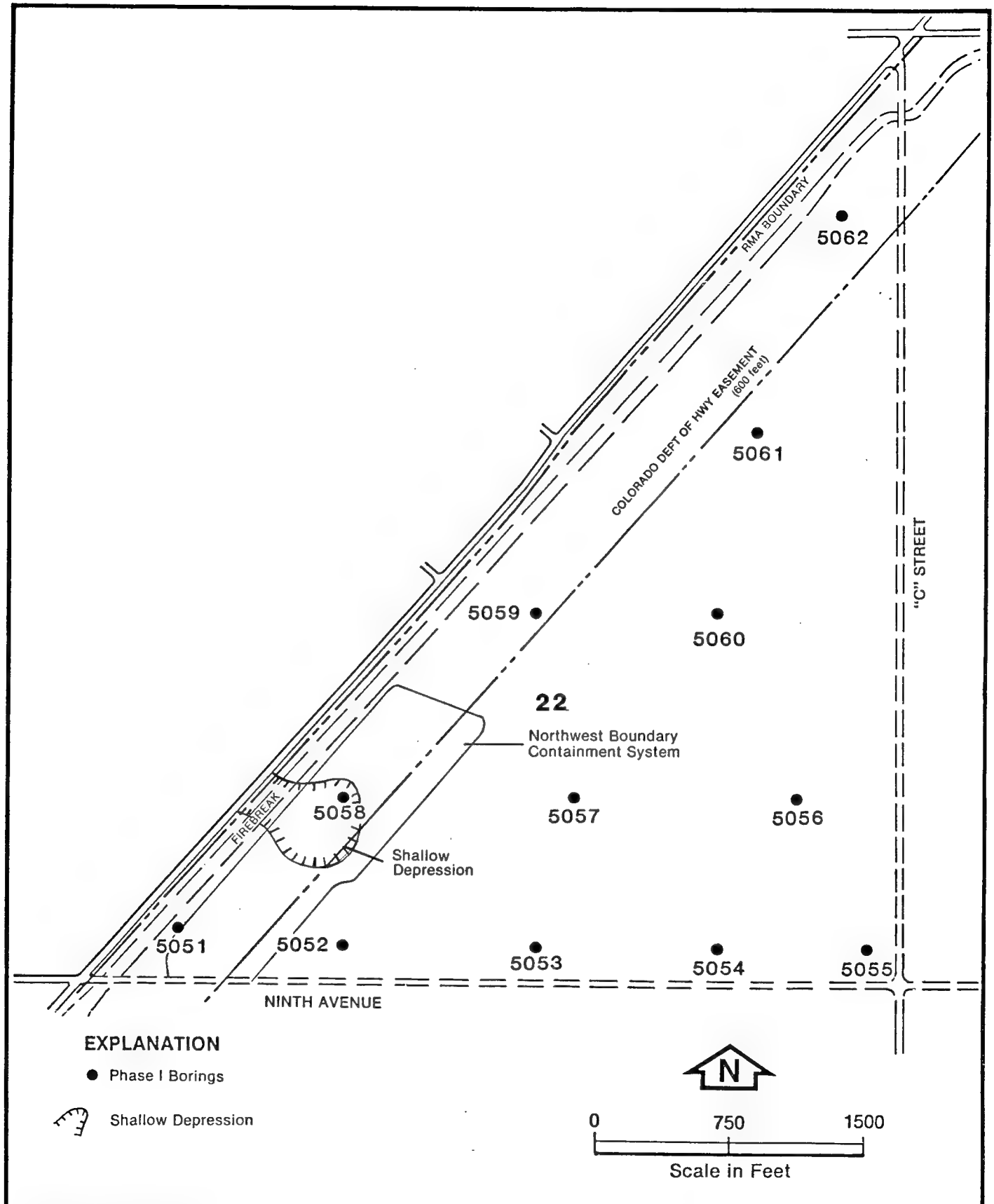


Figure 22-UNC-4
PHASE I INVESTIGATION
BORING LOCATION MAP
SECTION 22-UNC
SOURCE: ESE, 1987

Prepared for:
U.S. Army Program Manager's Office
For Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

A high photoionization detector (PID), calibrated to an isobutylene standard, was used to obtain readings from open boreholes during drilling and from soil samples during geologic logging. The PID measures the concentration of organic vapors in the air and is a method of ensuring personnel safety.

All samples were analyzed by gas chromatography/mass spectrometry (GC/MS) for semivolatile organic compounds and by inductively coupled argon plasma (ICP) analyses for cadmium, chromium, copper, lead, and zinc. All samples were analyzed for arsenic and mercury by atomic absorption (AA) spectroscopy. A GC/MS volatile organic analysis was not performed on samples from nonsource areas.

The Phase I remedial investigation program for this section was developed and implemented based on historical documentation, aerial photographs, and other information available at the time of its implementation. Since that time, previously unavailable information has been identified through the efforts of Acumenics, a contractor to the Department of Justice. This more recently available information has been incorporated into the history section of this report. Furthermore, this additional information has been evaluated in detail to determine how it might impact the investigation approach at this section. Based upon this evaluation, it has been determined that the additional information collected since the Phase I program was designed does not substantially alter the status of this section as a nonsource area. As a result, the Phase I program as conducted is judged to provide a complete and accurate investigation of this nonsource area.

3.2.2 Phase I Field Observations

Although historical evidence did not indicate the potential for the presence of chemical agents at this site, an M8 alarm was used as a safety precaution to detect the presence of chemical agents in boreholes and soil samples. The M8 alarm is used to detect Sarin (GB) and VX at detection levels of 0.2 and 0.4 milligrams per cubic meter (mg/m^3), respectively, after a response

time of 2 to 3 minutes (USAMDARC, 1982; USAMDARC, 1979). Many other substances, however, including smoke and engine exhaust, can activate the M8 alarm. No positive tests or alarm activation occurred at this source. PID readings during drilling were low (0.3) and posed no safety concern to drilling personnel.

Boring 5058 was drilled in the shallow depression noted near the center of the NWBCS. No unusal coloration indicative of disposal was visible in this or any other soil samples from Section 22-UNC.

3.2.3 Geophysical Exploration

A comprehensive surface geophysical program was not performed in Section 22-UNC, because historical information indicated that this is a nonsource area and there was no evidence of buried metal, trenches, or disposal pits.

3.2.4 Phase I Analyte Levels and Distribution

Table 22-UNC-1 contains indicator ranges and a statistical summary of Phase I analytical results. A summary of analytical data for each sample, including lithology and air monitoring results, is presented in Table 22-UNC-2. A listing of the target compounds and a tabulation of analytical data can be found in Appendices 22-UNC-A and 22-UNC-B. Concentrations within or above indicator ranges for Phase I data are presented in Figure 22-UNC-5.

To assess the significance of metal and organic analytical values, indicator ranges were established. For organic compounds, the indicator range is the method detection limit. For metals, a range of values was chosen to reflect the upper end of the expected natural range for each metal as normally found in RMA alluvial soil. The procedure for establishing indicator ranges is presented in the Introduction to the Contamination Assessment Reports (ESE, 1986a).

Of the 12 boreholes, one boring (5052) contained a cadmium level (2.7 ppm) above its indicator range (Table 22-UNC-2). The remainder of the samples

Table 22-UNC-1. Summary of Analytical Results for Section 22-UNC

Constituent	Number of Samples*	Concentrations (µg/g) Range	Mean	Median	Standard Deviation	ESE Detection Limit	MRI Detection Limit	Indicator Range
Volatiles (N=0)†								
Not analyzed								
Semivolatiles (N=12)†								
None detected								DL
ICP Metals (N=12)†								
Cadmium	1	2.7	--	--	--	0.90	0.50	DL-2
Chromium	12	10-19	14	13	2.2	7.2	7.4	25-40
Copper	12	18-28	21	21	2.9	4.8	4.9	20-35
Lead	3	19-27	--	--	--	17	16	25-40
Zinc	12	33-58	44	43	6.2	16	28	60-80
Arsenic (N=12)†	0	--	--	--	--	4.7	5.2	DL-10
Mercury (N=12)†	1	0.091	--	--	--	0.050	0.070	DL-0.1

* Number of samples in which constituent was detected.
† N=Number of samples analyzed.
-- Not calculated for less than five detections.
DL Detection limit.

Source: ESE, 1987.

Table 22-UNC-2. Concentrations of Target Analytes Above Detection Limits in Section 22-UNC

Bore Number	5051	5052	5053	5054	5055	5056	5057	5058	5059	5060	5061	5062
Depth (ft)	Comp	Comp	Comp	Comp	Comp	Comp	Comp	Comp	Comp	Comp	Comp	Comp
Geologic Material	Sandy Silt	Sandy Silt	Sandy Silt	Sandy Silt	Silty Sand	Silty Sand	Sandy Silt	Sandy Silt	Sandy Silt	Sandy Silt	Sandy Silt	Sandy Silt
AIR MONITORING												
PID*	BKD	BKD	BKD	0.5	0.3	0.3	0.3	0.3	0.3	0.3	0.3	BKD
SOIL CHEMISTRY												
Volatiles (µg/g)												
Not analyzed												
Semivolatiles (µg/g)												
None detected												
Metals (µg/g)												
Cadmium	BDL	2.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Chromium	13	10	13	12	14	13	13	14	15	13	17	19
Copper	21	21	21	18	19	18	19	22	22	22	25	28
Lead	21	19	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	27
Zinc	48	37	46	33	42	43	42	46	46	42	49	58
Arsenic (µg/g)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mercury (µg/g)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.091

* Calibrated to an isobutylene standard.
BKD No readings above ambient background.
BDL Below detection limit.
Comp. Composite Samples of 0-1 and 4-5 ft intervals.

Source: ESE, 1987.

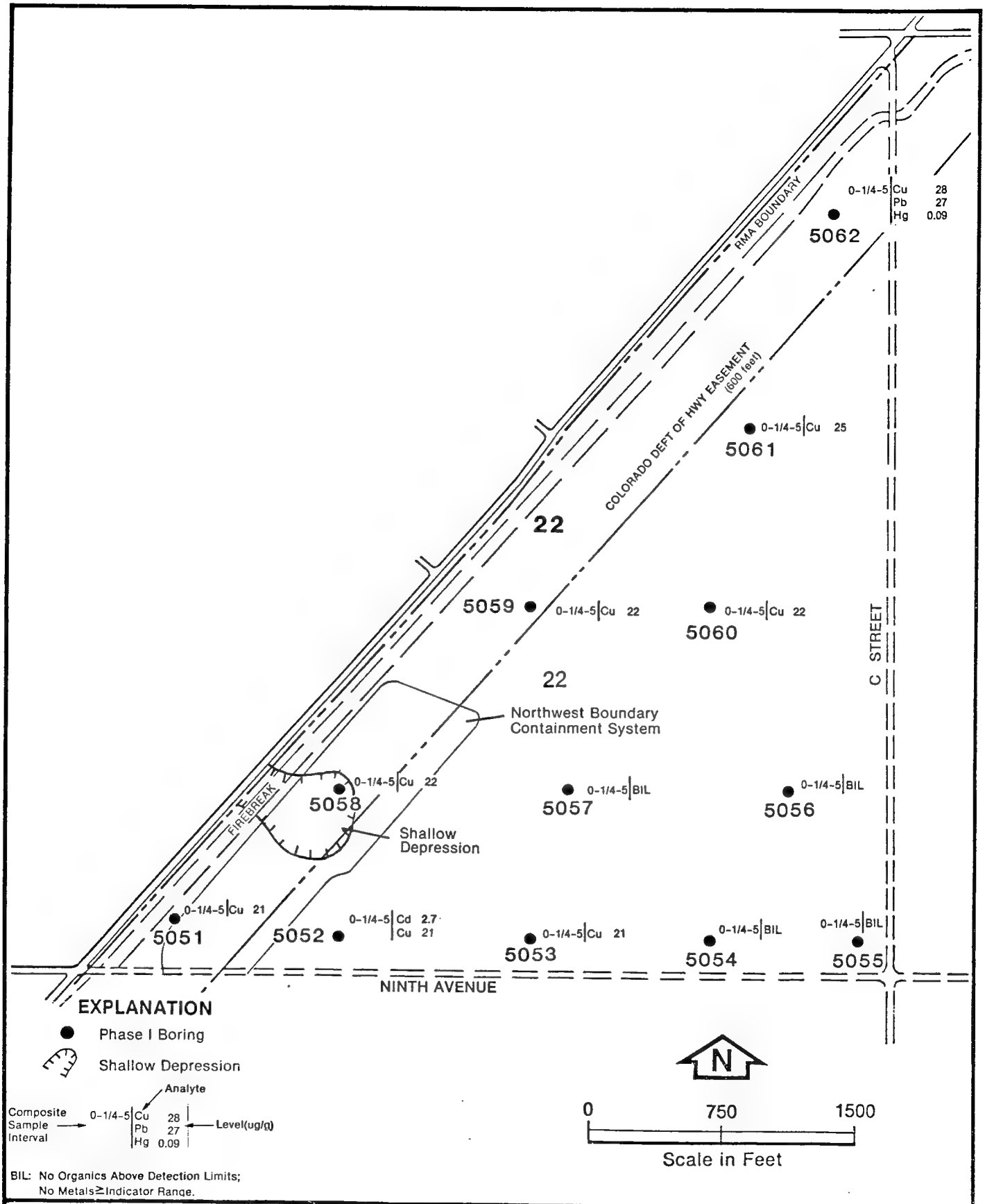


Figure 22-UNC-5
PHASE I INVESTIGATION
CHEMICAL ANALYSIS RESULTS
SECTION 22-UNC
SOURCE: ESE, 1987

Prepared for:
U.S. Army Program Manager's Office
For Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

contained metal concentrations within or below their indicator ranges. Eight borings (5051, 5052, 5053, 5058, 5059, 5060, 5061, and 5062) contained copper between 20 and 28 ppm. These values are at the lower end of the indicator range and are probably natural occurrences. Mercury was detected in Boring 5062 at 0.091 ppm, which is in the upper end of the indicator range. Target organic compounds were not detected in any Section 22-UNC sample.

Several compounds were detected by GC/MS that were not included in the target compound list and that were not conclusively identified. These compounds are included in the data presented in Appendix 22-UNC-B. Table 22-UNC-3 lists the boring number, sample interval depth, relative retention time (shown as "unknown number" on the table), concentration, sample number, lot, best-fit identification, and comments for these nontarget compounds detected at Section 22-UNC. It should be noted that an individual compound may have more than one retention time and that a particular retention time may be assigned to more than one compound. Table 22-UNC-3, therefore, provides only a general indication of additional compounds that may be present.

Most of the compounds in the nontarget analyses were identified as low-concentration, unknown hydrocarbons. An unknown phthalate (plasticizer) and hexadecanoic acid (which is derived from natural products) were also identified.

3.2.5 Phase I Contamination Assessment

Analytical results from the Phase I program support historical data indicating that Section 22-UNC is a nonsource area. With the exception of one cadmium concentration slightly above indicator range, metal concentrations in this section are consistent with natural alluvial concentrations. The cadmium concentration is not considered to be indicative of disposal activity, because historical evidence, aerial photographs, and visual observations did not indicate burial or disposal in Section 22-UNC. No semivolatile organic compounds were detected at

Table 22-UNC-3. Tentative Identification of Nontarget Compounds in Section 22-UNC Soil Samples

Borehole Number	Interval Depth (ft)	Unknown Number	Concentration Above Background (ppm)*	Sample Number	Lot	Best Fit	Comments†
5051	0-1/4-5	609	0.3	UN22-1	MJN	Unknown phthalate	c, f
		619	0.3	UN22-1	MJN	Hexadecanoic acid	d, f, h
		632	0.8	UN22-1	MJN	Unknown hydrocarbon	a, h
5052	0-1/4-5	632	0.4	UN22-2	MJN	Unknown hydrocarbon	a, h
5053	0-1/4-5	632	0.7	UN22-3	MJN	Unknown hydrocarbon	a, h
5054	0-1/4-5	632	0.6	UN22-4	MJN	Unknown hydrocarbon	a, h
5055	0-1/4-5	632	0.9	UN22-5	MJN	Unknown hydrocarbon	a, h
5056	0-1/4-5	632	1	UN22-6	MJN	Unknown hydrocarbon	a, h
5057	0-1/4-5	632	1	UN22-7	MJN	Unknown hydrocarbon	a, h
5058	0-1/4-5	632	1	UN22-8	MJN	Unknown hydrocarbon	a, h
5059	0-1/4-5	632	1	UN22-9	MJN	Unknown hydrocarbon	a, h
5060	0-1/4-5	632	1	UN22-10	MJN	Unknown hydrocarbon	a, h
5061	0-1/4-5	632	0.6	UN22-11	MJN	Unknown hydrocarbon	a, h
5062	0-1/4-5			UN22-12	MJN		i

* Values reported are blank corrected.

† a. No positive identification.
b. Surfactant.
c. Plasticizer (note: All phthalates and adipates will have this comment).
d. Derived from natural products.
e. Suspected laboratory contaminant.
f. Low concentration.
g. Low frequency of occurrence.
h. Ubiquitous.
i. Possible column bleed.
j. None detected.

Source: ESE, 1987.

Section 22-UNC. All nontarget compound concentrations were low and are not thought to be indicative of contamination.

The semivolatile GC/MS method applied to all Phase I samples, although not certified for volatile organic compounds, has been shown capable of detecting tetrachloroethylene, toluene, chlorobenzene, ethylbenzene, and xylene in the nontarget fraction at low recovery levels. The absence of these compounds in nontarget results for this site is an indication that contamination is not present from these compounds.

3.3 PHASE II SURVEY

A Phase II program is not recommended for Section 22-UNC, because target semivolatile organic compounds were not detected and most target metal concentrations were within or below their respective indicator ranges. A review of aerial photographs and historical evidence indicated that no disposal activities took place in Section 22-UNC.

Comments from Shell Chemical Company were received on July 1, 1987 and from the U.S. Environmental Protection Agency (EPA) on September 11, 1987. These comments were considered in the preparation of this final report and are presented with responses in Appendix 22-UNC-C. Comments from the Colorado Department of Health (CDH) were not received prior to the distribution of this report.

3.4 QUANTITY OF POTENTIALLY CONTAMINATED SOIL

No previous estimates of potentially contaminated soil were available for this site. Based on the Phase I results, visual observations, and historical evidence, Section 22-UNC is considered to be a nonsource area.

4.0 REFERENCES

RIC#85214R03
Anderson, B., Krell, J., and Jones, D. 1979. Tier I Data Files, Rocky Mountain Arsenal Field Drilling Files, Vols. 1-3.

Army Material Command. August 1973. Contamination Survey Rocky Mountain Arsenal. Appendix P, p. F-35, Microfilm RMA028, Frames 2033-2086, 2066.

Chemical Warfare Service. June 1946. Rocky Mountain Arsenal Land Use Map, Drawing No. C-14-B.

Chemical Warfare Service. November 18, 1948. Master Plan, Rocky Mountain Arsenal Reservation Boundary and Land Use Map, Drawing No. B-101 (Revised February 8, 1951).

RIC#85183R01
Clark, J. 1985. Section Plots and Well Summary. D.P. Associates, Inc.

RIC#85121P08
DeMontiony. July 1984. Aerial Photographs of the Rocky Mountain Arsenal, color Infrared. Intrasearch Inc.

Environmental Science and Engineering, Inc., (ESE). 1986a. Introduction to the Contamination Assessment Reports. Rocky Mountain Arsenal (Draft Report). Prepared for Office of the Program Manager, Rocky Mountain Arsenal.

RIC#86238R04
Environmental Science and Engineering, Inc. 1986b. Phase I Survey of Army Sites-North Technical Plan (Task 14), Rocky Mountain Arsenal. Prepared for Office of the Program Manager. Rocky Mountain Arsenal.

RIC#86238R08
Environmental Science and Engineering, Inc. 1986c. Water Quantity/Quality Survey: Initial Screening Program Report, Rocky Mountain Arsenal. (Draft Final Report) Vols. I, II, and III. Prepared for Office of the Program Manager, Rocky Mountain Arsenal.

RIC#82295R01
May, J. 1982. Regional Ground Water Study of Rocky Mountain Arsenal: Part I Hydrogeological Definition. Waterways Experiment Station (WES).

Rocky Mountain Arsenal. August 15, 1963. Master Plan Preliminary Land-Use Map. Drawing No. 18-02-01.

RIC#83080P02
Rocky Mountain Arsenal. 1983. Aerial Photograph of the Rocky Mountain Arsenal, Black and White.

RIC#83326R01
Rocky Mountain Arsenal Contamination Control Program Management Team (RMACCMPT). 1983. Selection of a Contamination Control Strategy for Rocky Mountain Arsenal, Vols. I and II. Final Report.

RIC#84034R01
Rocky Mountain Arsenal Contamination Control Program Management Team (RMACCPMT). January 1984. Installation Restoration at Rocky Mountain Arsenal, Decontamination Assessment for Land and Facilities at Rocky Mountain Arsenal. Draft Final Report. p.3-3. Microfilm RSH888, Frames 1177-1328, 1221.

Sampson, J.S., and Baber, T.G. 1974. Soil Survey of Adams County, Colorado. U.S. Soil Conservation Service (SCS). 77 pp. plus maps.

RIC#81293R05
Stollar, R.L., and van der Leeden, F. 1981. Evaluation of the Hydrogeologic System and Contamination Migration Patterns. Final Report.

U.S. Army Chemical Corps. 1945. History of Rocky Mountain Arsenal. Vol. I, Part I, Aerial Photograph of Rocky Mountain Arsenal (July 9, 1943). p. 31. Microfilm RMA188, Frame 0057.

U.S. Army Materiel Development and Readiness Command (USAMDARC). 1979. Safety Regulations for Chemical Agent H. DARCOM-R 385-31. Department of the Army.

U.S. Army Materiel Development and Readiness Command (USAMDARC). 1982. Safety Regulations for Chemical Agents GB and VX. DARCOM-R 385-102. Department of the Army.

APPENDIX 22-UNC-A
CHEMICAL NAMES, METHODS, AND ABBREVIATIONS

APPENDIX 22-UNC-A
CHEMICAL NAMES, METHODS, AND ABBREVIATIONS

PHASE I ANALYTES AND CERTIFIED METHODS

Analytes/Methods	Synonymous Names and Abbreviations	Standard Abbreviations
VOLATILE ORGANIC COMPOUNDS/GCMS	VOL	VO
1,1-Dichloroethane	1,1-Dichloroethane	11DCLE
1,2-Dichloroethane	1,2-Dichloroethane	12DCLE
1,1,1-Trichloroethane (TCA)	1,1,1-Trichloroethane	111TCE
1,1,2-Trichloroethane	1,1,2-Trichloroethane	112TCE
Benzene	Benzene	C_6H_6
Bicycloheptadiene	Bicycloheptadiene (BCHD)	BCHPD
Carbon tetrachloride	Carbon tetrachloride	CCL_4
Chlorobenzene	Chlorobenzene	CLC_6H_5
Chloroform	Chloroform	$CHCL_3$
Dibromochloropropane	Dibromochloropropane	DBCP
Dicyclopentadiene	Dicyclopentadiene	DCPD
Dimethyldisulfide	Dimethyldisulfide	DMDS
Ethylbenzene	Ethylbenzene	ETC_6H_5
m-Xylene	meta-Xylene	13DMB
Methylene chloride	Methylene chloride	CH_2CL_2
Methylisobutyl ketone	Methylisobutyl ketone	MIBK
o,p-Xylene	ortho- and/or para-Xylene	XYLEN
Tetrachloroethene (PCE)	Tetrachloroethylene	TCLEE
Toluene	Toluene	MEC_6H_5
Trans 1,2-dichloroethene	Trans 1,2-dichloroethylene	12DCE
Trichloroethene (TCE)	Trichloroethylene	TRCLE
SEMIVOLATILE ORGANIC COMPOUNDS/GCMS	EXTRACTABLE ORGANIC COMPOUNDS (EX)	SVO
1,4-Oxathiane	1,4-Oxathiane	OXAT
2,2-Bis (para-chlorophenyl)-1,1-dichloroethane	Dichlorodiphenylethane	PPDDE
2,2-Bis (para-chlorophenyl) 1,1,1-trichloroethane	Dichlorodiphenyltrichloroethane	PPDDT
Aldrin	Aldrin	ALDRN
Atrazine	Atrazine	ATZ
Chlordane	Chlordane	CLDAN
Chlorophenylmethyl sulfide	p-Chlorophenylmethyl sulfide	CPMS
Chlorophenylmethyl sulfoxide	p-Chlorophenylmethyl sulfoxide	CPMSO
Chlorophenylmethyl sulfone	p-Chlorophenylmethyl sulfone	$CPMSO_2$
Dibromochloropropane	Dibromochloropropane	DBCP
Dicyclopentadiene	Dicyclopentadiene	DCPD
Dieldrin	Dieldrin	DLDRN
Diisopropylmethyl phosphonate	Diisopropylmethyl phosphonate	DIMP

APPENDIX 22-UNC-A
CHEMICAL NAMES, METHODS, AND ABBREVIATIONS

Analytes/Methods	Synonymous Names and Abbreviations	Standard Abbreviations
SEMIVOLATILE ORGANIC COMPOUNDS (CONT)		
Dimethylmethyl phosphonate	Dimethylmethyl phosphonate	DMMP
Dithiane	Dithiane	DITH
Endrin	Endrin	ENDRN
Hexachlorocyclopentadiene	Hexachlorocyclopentadiene (HCPD)	CL_6CP
Isodrin	Isodrin	ISODR
Malathion	Malathion	MLTHN
Parathion	Parathion	PRTHN
Supona	2-Chloro-1(2,4-dichlorophenyl) vinyldiethyl phosphate	SUPONA
Vapona	Vapona	DDVP
METALS/ICP	ICAP	ICP
Cadmium	Cadmium	CD
Chromium	Chromium	CR
Copper	Copper	CU
Lead	Lead	PB
Zinc	Zinc	ZN
SEPARATE ANALYSES		
Arsenic/AA	Arsenic	AS
Mercury/AA	Mercury	HG

APPENDIX 22-UNC-A
CHEMICAL NAMES, METHODS, AND ABBREVIATIONS

PHASE II ANALYTES AND CERTIFIED METHODS

Analytes/Methods	Synonymous Names and Abbreviations	Standard Abbreviations
VOLATILE ORGANIC COMPOUNDS/GCMS (Same as Phase I)	VOL	VO
SEMIVOLATILE ORGANIC COMPOUNDS/GCMS (Same as Phase I)	EXTRACTABLE ORGANIC COMPOUNDS (EX)	SVO
VOLATILE HALOCARBON COMPOUNDS/GCCON	PURGEABLE HALOCARBONS (PHC)	VHO
1,1-Dichloroethane	1,1-Dichloroethane	11DCLE
1,2-Dichloroethane	1,2-Dichloroethane	12DCLE
1,1-Dichloroethene	1,1-Dichloroethene	11DCE
1,1,1-Trichloroethane (TCA)	1,1,1-Trichloroethane	111TCE
1,1,2-Trichloroethane	1,1,2-Trichloroethane	112TCE
Carbon tetrachloride	Carbon tetrachloride	CCL_4
Chlorobenzene	Chlorobenzene	CLC_6H_5
Chloroform	Chloroform	$CHCL_3$
Methylene chloride	Methylene chloride	CH_2CL_2
Trans 1,2-dichloroethylene	Trans 1,2-dichloroethene	12DCE
Tetrachloroethene (PCE)	Tetrachloroethylene	TCLEE
Trichloroethene (TCE)	Trichloroethylene	TRCLE
VOLATILE HYDROCARBON COMPOUNDS/GCFID	DCPD	HYDCBN
Bicycloheptadiene	Bicycloheptadiene (BCHD)	BCHPD
Dicyclopentadiene	Dicyclopentadiene	DCPD
Methylisobutyl ketone	Methylisobutyl ketone	MIBK
VOLATILE AROMATIC COMPOUNDS/GCPID	PURGEABLE AROMATICS (PAM)	VAO
Benzene	Benzene	C_6H_6
Ethylbenzene	Ethylbenzene	ETC_6H_5
m-Xylene	meta-Xylene	13DMB
o,p-Xylene	ortho- and/or para-Xylene	XYLEN
Toluene	Toluene	MEC_6H_5
ORGANOCHLORINE PESTICIDES/GCEC		OCP
2,2-Bis (para-chlorophenyl)-1,1-dichloroethane	Dichlorodiphenylethane	PPDDE
2,2-Bis (para-chlorophenyl)-1,1,1-trichloreoethane	Dichlorodiphenyltrichloroethane	PPDDT
Aldrin	Aldrin	ALDRN
Chlordane	Chlordane	CLDAN
Dieldrin	Dieldrin	DLDRN
Endrin	Endrin	ENDRN
Hexachlorocyclopentadiene	Hexachlorocyclopentadiene	CL_6CP
Isodrin	Isodrin	ISODR

APPENDIX 22-UNC-A
CHEMICAL NAMES, METHODS, AND ABBREVIATIONS

Analytes/Methods	Synonymous Names and Abbreviations	Standard Abbreviations
ORGANOPHOSPHOROUS PESTICIDES/GCNPD	ORGANOPHOSPHOROUS COMPOUNDS (OPC)	OPP
Atrazine	Atrazine	ATZ
Malathion	Malathion	MLTHN
Parathion	Parathion	PRTHN
Supona	2-Chloro-1(2,4-dichlorophenyl) vinyldiethyl phosphate	SUPONA
Vapona	Vapona	DDVP
ORGANOPHOSPHOROUS COMPOUNDS/GCFPD	DIMP	OPC
Diisopropylmethyl phosphonate	Diisopropylmethyl phosphonate	DIMP
Dimethylmethyl phosphonate	Dimethylmethyl phosphonate	DMMP
ORGANOSULPHUR COMPOUNDS/GCFPD		OSC
1,4-Oxathiane	1,4-Oxathiane	OXAT
Benzothiazole	Benzothiazole	BTZ
Chlorophenylmethyl sulfide	p-Chlorophenylmethyl sulfide	CPMS
Chlorophenylmethyl sulfone	p-Chlorophenylmethyl sulfone	$CPMSO_2$
Chlorophenylmethyl sulfoxide	p-Chlorophenylmethyl sulfoxide	CPMSO
Dimethyldisulfide	Dimethyldisulfide	DMDS
Dithiane	Dithiane	DITH
METALS/ICP	ICAP	ICP
Cadmium	Cadmium	CD
Chromium	Chromium	CR
Copper	Copper	CU
Lead	Lead	PB
Zinc	Zinc	ZN
SEPARATE ANALYSES		
Arsenic/AA	Arsenic	AS
Mercury/AA	Mercury	HG

ENVIRONMENTAL SCIENCE & ENGINEERING 02/25/87 STATUS: PAGE# 1

PROJECT NUMBER 85937 0420 PROJECT NAME RMA ONPOST TASK14
FIELD GROUP UN22 PROJECT MANAGER M. WITT
UN22X LAB COORDINATOR PAUL GEISZLER

PARAMETERS	STORET #	SAMPLE ID/# 5051 UN22	5052 UN22	5053 UN22	5054 UN22	5055 UN22	5056 UN22	5057 UN22	5058 UN22	5059 UN22	5060 UN22	5061 UN22	5062 UN22	BLK UN22	BLK UN22
UNITS	METHOD	1	2	3	4	5	6	7	8	9	10	11	12	80	90
DATE		11/13/85	11/13/85	11/13/85	11/14/85	11/14/85	11/14/85	11/14/85	11/14/85	11/14/85	11/14/85	11/14/85	11/18/85	11/13/85	11/13/85
TIME		10:26	11:15	11:51	08:28	09:11	09:43	10:15	10:49	13:19	13:59	00:00	13:53	00:00	00:00
SAMPLE TYPE	71999 0	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
SAMPLE DEPTH FT	99758A 0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SITE TYPE 1	99759 0	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	QCMB	QCMB
INSTALLATION CODE	99720 0	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK	RK
SAMPLE SAMPLING TECHNIQUE	72005 0	S	S	S	S	S	S	S	S	S	S	S	S	G	G
COORDINATE,N/S STP	98392 0	191379	191231	191239	191248	191261	192103	192097	192087	193101	193099	194102	195383		
COORDINATE,E/W STP	98393 0	2174132	2175125	2176129	2177133	2178131	2177777	2176575	2175383	2176285	2177278	2177522	2177967		
MOISTURE %WET WT	70320 0	6.7	7.6	9.1	9.3	10.4	10.0	8.0	9.8	11.6	6.4	6.7	8.6	2.4	0.01
CADMIUM UG/G- DRY	1028 0	<0.510	2.71	<0.510	<0.510	<0.510	<0.510	<0.510	<0.510	<0.510	<0.510	<0.510	<0.510	NA	<0.510
CHROMIUM UG/G-DRY	99584 0	12.7	10.1	12.8	12.1	14.4	12.6	13.4	13.7	14.7	13.2	16.7	18.7	NA	10.3
COPPER UG/G- DRY	1043 0	21.1	20.6	21.3	17.8	18.6	17.9	19.2	21.8	21.5	22.1	24.7	28.1	NA	16.8
LEAD UG/G-DRY	1052 0	21.4	19.4	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	26.8	NA	<16.0
ZINC UG/G-DRY	1093 0	47.9	37.3	46.2	33.2	42.5	42.9	42.4	46.0	45.6	42.2	48.6	58.4	NA	35.1
ARSENIC UG/G- DRY	1003 0	<5.20	<5.20	<5.20	<5.20	<5.20	<5.20	<5.20	<5.20	<5.20	<5.20	<5.20	<5.20	NA	<5.20
MERCURY UG/G-DRY	71921 0	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.091	<0.050	<0.070
ALDRIN UG/G- DRY	98356 0	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500		<0.500
DIELDRIN UG/G-DRY	98365 0	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600		<0.600
DDT,PP' UG/G-DRY	98364 0	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00		<2.00
ENDRIN UG/G-DRY.	98369 0	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00		<4.00
CHLORDANE UG/G- DRY	98361 0	<6.00	<6.00	<6.00	<6.00	<6.00	<6.00	<6.00	<6.00	<6.00	<6.00	<6.00	<6.00		<6.00

PROJECT NUMBER 85937 0420 PROJECT NAME RMA ONPOST TASK14
FIELD GROUP UN22 PROJECT MANAGER M. WITT
UN22X LAB COORDINATOR PAUL GEISZLER

PARAMETERS	STORET #	SAMPLE ID/# 5051 UN22 1	5052 UN22 2	5053 UN22 3	5054 UN22 4	5055 UN22 5	5056 UN22 6	5057 UN22 7	5058 UN22 8	5059 UN22 9	5060 UN22 10	5061 UN22 11	5062 UN22 12	BLK UN22 80	BLK UN22 90
UNITS	METHOD														
DATE		11/13/85	11/13/85	11/13/85	11/14/85	11/14/85	11/14/85	11/14/85	11/14/85	11/14/85	11/14/85	11/14/85	11/18/85	11/13/85	11/13/85
TIME		10:26	11:15	11:51	08:28	09:11	09:43	10:15	10:49	13:19	13:59	00:00	13:53	00:00	00:00
DDE,PP'	98363	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500		<0.500
UG/G-DRY	0														
1,4 OXATHIANE	98644	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500		<0.500
UG/G-DRY	0														
DIMP	98645	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00		<3.00
UG/G-DRY	0														
VAPONA	98646	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300		<0.300
UG/G -DRY	0														
HEXACHLOROCYCLOPENT-	98647	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00		<1.00
ADIENE UG/G-DRY	0														
MALATHION	98648	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00		<2.00
UG/G-DRY	0														
ISODRIN	98649	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600		<0.600
UG/G-DRY	0														
1,4 DITHIANE	98650	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00		<2.00
UG/G- DRY	0														
DICYCLOPENTADIENE	98651	<6.00	<6.00	<6.00	<6.00	<6.00	<6.00	<6.00	<6.00	<6.00	<6.00	<6.00	<6.00		<6.00
UG/G-DRY	0														
DBCP(NEMAGON)	98652	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005		<0.005
UG/G-DRY	0														
P-CLPHENYLMETHYL-	98653	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300		<0.300
SULFIDE UG/G-DRY	0														
P-CLPHENYLMETHYL-	98654	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00		<1.00
SULFOXIDE UG/G-DRY	0														
ATRAZINE	98655	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500		<0.500
UG/G-DRY	0														
SUPONA	98656	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900	<0.900		<0.900
UG/G-DRY.	0														
DMMP	98657	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00		<3.00
UG/G-DRY	0														
PARATHION	98658	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00		<2.00
UG/G-DRY	0														
P-CLPHENYLMETHYL-	98703	<0.400	<0.400	<0.400	<0.400	<0.400	<0.400	<0.400	<0.400	<0.400	<0.400	<0.400	<0.400		<0.400
SULFONE UG/G-DRY	0														
UNK609	90066	0.322													
UG/G	0														
UNK619	90105	0.322													
UG/G	0														
UNK632	90084	0.858	0.433	0.660	0.551	0.893	1.11	0.978	1.11	1.13	1.07	0.643			
UG/G	0														

PROJECT NUMBER 85937 0420 PROJECT NAME RMA ONPOST TASK14
FIELD GROUP UN22 PROJECT MANAGER M. WITT
UN22X LAB COORDINATOR PAUL GEISZLER

PARAMETERS	UNITS	STORET #	METHOD	SAMPLE ID/# BLK UN22 91	BLK UN22 92
DATE				11/14/85	11/18/85
TIME				00:00	00:00
SAMPLE TYPE		71999	0	SO	SO
SAMPLE DEPTH	FT	99758A	0	0.0	0.0
SITE TYPE 1		99759	0	QCMB	QCMB
INSTALLATION CODE		99720	0	RK	RK
SAMPLING TECHNIQUE	SAMPLE	72005	0	G	G
COORDINATE,N/S	STP	98392	0		
COORDINATE,E/W	STP	98393	0		
MOISTURE	%WET WT	70320	0	0.01	0.01
CADMIUM	UG/G- DRY	1028	0		
CHROMIUM	UG/G-DRY	99584	0		
COPPER	UG/G- DRY	1043	0		
LEAD	UG/G-DRY	1052	0		
ZINC	UG/G-DRY	1093	0		
ARSENIC	UG/G- DRY	1003	0		
MERCURY	UG/G-DRY	71921	0	NA	NA
ALDRIN	UG/G- DRY	98356	0		
DIELDRIN	UG/G-DRY	98365	0		
DDT,PP'	UG/G-DRY	98364	0		
ENDRIN	UG/G-DRY.	98369	0		
CHLORDANE	UG/G- DRY	98361	0		

PROJECT NUMBER 85937 0420 PROJECT NAME RMA ONPOST TASK14
FIELD GROUP UN22 PROJECT MANAGER M. WITT
UN22X LAB COORDINATOR PAUL GEISZLER

SAMPLE ID/#

PARAMETERS	STORET #	BLK UN22	BLK UN22
UNITS	METHOD	91	92
DATE		11/14/85	11/18/85
TIME		00:00	00:00
DDE,PP'	98363		
UG/G-DRY	0		
1,4 OXATHIANE	98644		
UG/G-DRY	0		
DIMP	98645		
UG/G-DRY	0		
VAPONA	98646		
UG/G -DRY	0		
HEXACHLOROCYCLOPENT-	98647		
ADIENE UG/G-DRY	0		
MALATHION	98648		
UG/G-DRY	0		
ISODRIN	98649		
UG/G-DRY	0		
1,4 DITHIANE	98650		
UG/G- DRY	0		
DICYCLOPENTADIENE	98651		
UG/G-DRY	0		
DBCP(NEMAGON)	98652		
UG/G-DRY	0		
P-CLPHENYLMETHYL-	98653		
SULFIDE UG/G-DRY	0		
P-CLPHENYLMETHYL-	98654		
SULFOXIDE UG/G-DRY	0		
ATRAZINE	98655		
UG/G-DRY	0		
SUPONA	98656		
UG/G-DRY.	0		
DMMP	98657		
UG/G-DRY	0		
PARATHION	98658		
UG/G-DRY	0		
P-CLPHENYLMETHYL-	98703		
SULFONE UG/G-DRY	0		
UNK609	90066		
UG/G	0		
UNK619	90105		
UG/G	0		
UNK632	90084		
UG/G	0		

cc: Mr. Thomas Bick
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FINAL RESPONSE TO SPECIFIC COMMENTS OF SHELL OIL COMPANY ON THE TASK 14 DRAFT FINAL PHASE I REPORT SECTION 22 - NONSOURCE AREA

Comment 1:

p. 10

Several of the topographic features identified in the aerial photograph analysis (pages 6-7) are suggestive of possible testing or disposal activities, i.e., several circular discolored areas (1980 photograph). Interpretations of these features should be provided and/or sampling should be carried out to investigate possible contamination.

Response:

Historical documentation, aerial photographs, field reconnaissance, and Phase I analytical data indicate that Section 22-UNC was not used for disposal activities or testing. These light-colored areas appear to be due to prairie dog activity and associated variations in vegetative stand types.

Comment 2:

p. 16

The conclusions stated are not valid in the absence of investigations of the topographic features listed in item 1, above.

Response:

As noted above, the light-colored areas are thought to be related to prairie dog rather than disposal activity. Since Section 22-UNC was a buffer zone and agricultural area, the section was considered to be a nonsource area prior to the Phase I investigation. Phase I analytical results, historical evidence, and aerial photographs indicate that Section 22-UNC is a nonsource area.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
999 18th STREET—SUITE 500
DENVER, COLORADO 80202-2405

AUG 2 0 1987

REF: 8HWM-SR

Colonel W. N. Quintrell
Program Manager
AMXRM-EE Department of the Army
U.S. Army Toxic and Hazardous Materials Agency
Building 4460
Aberdeen Proving Ground, MD 21010-5401

Re: Rocky Mountain Arsenal (RMA),
Review of Final Draft CAR for Task 14,
Section 19-UNC, Section 22-UNC, Section
27-UNC, Section 28-UNC

Dear Colonel Quintrell:

EPA Region VIII has reviewed the above referenced final draft reports. We believe that the information available to date indicates that sites "Section 19-UNC, Section 22-UNC, Section 27-UNC, Section 28-UNC " are in need of further evaluation. For these sites, as well as for each of the other RMA sites which may be uncontaminated, additional measures need to be undertaken, as discussed by our technical staffs and noted in my letter of July 24, 1987 on other potentially uncontaminated sites. These measures are:

- Soil sampling results will have to be integrated with ground water data and carefully analyzed during the RI phase.

- An adequate rationale showing the effectiveness of the method of compositing soil samples must be provided. Lacking that, a demonstration must be made that the sampling scheme and other data sets were effective and sufficiently sensitive to support conclusions. Specifically, was the method of compositing soil samples from different depths adequate, how sensitive was the sampling to the stratigraphy or soil horizons, were samples taken from appropriate depths, and were a sufficient number of samples taken? The outcome of the demonstration and analysis could be that further studies are necessary.

- A comparison of the results of the soils/ground water analysis with cleanup levels will have to be made.

These measures are needed before any final decision on a remediation plan, or lack thereof for an uncontaminated site, can be reached. Therefore any conclusion at this time that a site is uncontaminated is premature. We look forward to the receipt and review of plans for accomplishing these additional measures to allow the eventual remediation decision.

In addition, it would expedite analysis if in future reports the control points were plotted on the maps. To ease in the general understanding of the inter-relationships of the several tasks, it would be preferred to have more cross referencing to other task reports. These changes would provide a better understanding of the program and information from each separate report.

Other review comments on the subject Draft CARs are enclosed. Our contact on this matter is Mr. Connally Mears at (303) 293-1528.

Sincerely yours,

Robert L. Duprey, Director
Hazardous Waste Management Division

Enclosures

cc: David Stelton, CDH
Chris Hahn, Shell Oil Company
R. D. Lundahl, Shell Oil Company
Thomas Bick, Department of Justice
Elliott Laws, Department of Justice

**FINAL RESPONSES TO GENERAL COMMENTS OF
U.S. ENVIRONMENTAL PROTECTION AGENCY ON
TASK 14 DRAFT FINAL PHASE I REPORT
SECTION 22 - NONSOURCE AREA**

Comment 1: Soil sampling results will have to be integrated with ground water data and carefully analyzed during the RI phase.

Response: This will addressed in the Regional Study Area Reports, which are currently in preparation.

Comment 2: An adequate rationale showing the effectiveness of the method of compositing soil samples must be provided. Lacking that, a demonstration must be made that the sampling scheme and other data sets were effective and sufficiently sensitive to support conclusions. Specifically, was the method of compositing soil samples from different depths adequate, were samples taken from appropriate depths, and were a sufficient number of samples taken? The outcome of the demonstration and analysis could be that further studies are necessary.

Response: The Remedial Investigation of the portions of RMA with no history of contamination was designed to maximize the probability of finding undocumented near-surface sources of contamination in these areas. This investigation program includes the review of all pertinent historical documents, interviews with knowledgeable persons, careful examination of aerial photographs spanning the time frame during which RMA was active, and field observations of the area. This program is similar to and in some respects exceeds that typically employed for a CERCLA Preliminary Assessment (PA). This primary program was augmented with a limited soil boring program, the purposes of which were a) to obtain representative samples and analytical results using a standardized grid pattern to better define background soils chemical characteristics and to identify broad scale anomalies, and b) to obtain representative samples and analytical results from locations deemed to have the greatest likelihood of containing contaminants (e.g., surface depressions, ditches, unexplained scars or markings noted on aerial photographs, etc.). This sampling program was conducted even when no evidence of waste disposal or handling activities was found through the PA-type program.

The Phase I investigation which included compositing 0 to 1-ft and 4- to 5-ft samples, was devised as the most cost-effective means to provide a timely contamination assessment of the largely unused portions of RMA. The nonsource area sample collection and preparation

techniques differ only in significance from those used for site borings being analyzed for volatiles. An undisturbed soil sample is collected in the field and sent to the laboratory for analysis for both site borings and nonsource area borings. Sample preparation for a site boring is as follows:

1. The sample is opened and the first one-inch is discarded.
2. A 1-in core tube sample is taken from the full length of the sample interval and placed in methanol-this sample is analyzed for volatiles.
3. A 1-in core tube sample is collected from the full length of the sample interval.
4. The sample core is placed in an amber glass bottle and mixed.
5. The sample is then split and analyzed for semivolatiles and other requested analytes.

Sample preparation for a nonsource area boring is as follows:

1. Sample intervals to be composited, usually 0- to 1-ft and 4- to 5-ft, are opened and the first 1 inch is discarded.
2. A 1-inch core tube sample is collected from the full length of each interval to be composited.
3. Sample cores collected from each interval are placed in an amber glass bottle and mixed. This is the compositing step.
4. The sample is then split and analyzed for semivolatiles and other requested analytes.

The mixing of the samples being composited occurs under the same conditions as the mixing of a site sample being prepared for semivolatile analysis. PMO's nonsource area sample collection and preparation techniques parallel those used by the U.S. Environmental Protection Agency (EPA) at their Superfund sites. Samples to be analyzed for semivolatiles are collected by EPA as disturbed samples, i.e., soil is placed in a glass jar. The sample is then sent to the laboratory and undergoes the same mixing and splitting procedure identified above for nonsource area samples, except there is no compositing. If any significant concentrations of contaminants existed, the small dilution factor involved in compositing two samples would not mask high concentrations. This procedure offers the advantage of screening two intervals at one time. If contaminants are found in the composite, additional samples for a Phase II study are obtained at both intervals and analyzed separately. It is difficult to determine whether EPA would consider this program "adequate," "appropriate," or "sufficient," since no basis for

FINAL RESPONSE TO SPECIFIC COMMENTS OF THE U.S. ENVIRONMENTAL PROTECTION AGENCY ON THE TASK 14 DRAFT FINAL PHASE I REPORT SECTION 22 - NONSOURCE AREA

Comment 1:
Executive Summary — Because the Phase 1 investigation indicated that Section 22 is uncontaminated, there are no volume estimates..." It is premature to say that Section 22 is uncontaminated, as noted in the cover letter, even though Phase I soil samples found no contamination.

Response: No attempt is being made to characterize areas of RMA as contaminated or uncontaminated based on the results of the Phase I soil boring program alone. However, the review of all pertinent historical documents, interviews with knowledgeable persons, examination of aerial photographs, field observations of the section, and Phase I results indicate that Section 22-UNC is a nonsource area.

Comment 2:
p. 4 — There is no indication that Section 22-UNC contributes to ground water contamination beneath this site. If the contamination in the ground water is not associated with known surface spills or activities in Section 22, then Task 23 must provide analytical tools to help identify the contamination sources.

Response: The source of the ground water contamination is currently being investigated and will be discussed in the forthcoming Regional Study Area Reports. The migration of contaminants in the ground water beneath this section is currently being assessed under Task 25.

Comment 3:
p. 8 — It is recommended that an additional boring be placed in the topographic depression adjacent to the center of the NWBCS.

Response: Boring 5058 was drilled in this natural depression. Target compound concentrations were not above the indicator range and only one nontarget compounds, an unknown hydrocarbon, was found.

Comment 4: Several possible manmade features were identified in the aerial photograph descriptions. Were the features adequately investigated by the soil borings and if so which ones were? Location of the manmade features in relation to the locations of the soil borings should be plotted to better facilitate evaluation.

Response: Most of these features or light-colored areas were indicative of pairie dog rather than disposal activities. Historical evidence, field observations, and Phase I data indicate that disposal activities did not take place in this section.

RESPONSES TO SPECIFIC COMMENTS OF THE COLORADO DEPARTMENT OF HEALTH ON THE DRAFT FINAL TASK 14 REPORT SECTION 22 - NONSOURCE AREA

Comments were not received from the Colorado Department of Health prior to the distribution of this report. A period of 6 months was extended to CDH to furnish their comments.